Remarks

With regard to the objection to the drawings, the applicants are submitting replacement sheets for Figures 13 and 14, in which the spelling of the word *gas* has been corrected.

With regard to point 5 of the office action, the word *a* has been inserted where appropriate in claim 1.

With regard to point 9, claim 1 has been corrected to refer to the deposited silica films.

With regard to point 12, claim 24, which has not objected to under the written description requirement has been incorporated in claim 21.

With regard to point 14, a terminal disclaimer is submitted herewith in respect of each of the patents cited.

Claims 1 and 21 have been amended to specify that the silica films are free of boron and phosphorus dopants. Support for this claim is found on page 28, line 29 and page 33, line 8. One of the advantages of the novel process is that it does not require the use of B and/or P.

It is believed that the above actions overcome all objections up to point 18, where the Examiner rejects the claims under 35 USC 103(a).

The present invention is concerned with the manufacture of high quality optical films in the manufacture of silica waveguides (See for example page 1, lines 3-7) and indeed represents an important contribution in this art because it teaches how to achieve higher quality optical films than were hitherto possible without annealing at high temperatures. Claims 1 and 21 have been limited to a method of making films in the manufacture of such waveguides. The applicants teach how to improve optical quality in such waveguides. The preamble is limiting in this case since the claims states that the method is carried out in the manufacture of such waveguides; such a preamble is not merely a statement of intended use.

The Examiner's primary reference is Bouffard, which clearly has nothing whatsoever to do with optical waveguides, and realistically this reference would be of no assistance to a person skilled in the art seeking to improve the quality of optical waveguides. The issue

therefore is primarily whether Bouffard inherently teaches or renders obvious the method claimed.

Firstly, it is respectfully submitted that claim 1 is non analogous art to the manufacture of optical waveguides. The Federal circuit stated *in In re Wood*, 202 USPQ 171, that

> "we presume knowledge by the inventor of all the prior art in the field of his endeavour. However, with regard to prior art outside the filed of his endeavor, we presume knowledge from those arts reasonably pertinent to the particular problem with which the inventor was involved." (emphasis added)

And in *In re Clay*, 23 USPQ 2d 1058, the Federal circuit stated:

> [a] reference is reasonably pertinent if … it is one which, because of the matter with which it deals, logically would have commended itself to the inventor's attention in considering his problem…If a reference has the same purpose as the claimed invention, the reference relates to the same problem… [I]f it is directed to a different purpose, the inventor would accordingly have less motivation or occasion to consider it."

Bouffard teaches a method of making BPSG for use as an insulating material (see col. 1, line 20), wherein the object is to allow it to flow at lower temperatures to smooth steps and fill trenches. This is not a problem that arises in the manufacture of optical waveguides since no reflow process is employed. Clearly, Bouffard would not commend itself to one seeking to improve the optical quality of films in waveguides. The optical quality of Bouffard's films is irrelevant since Bouffard is using them as insulators, not parts of optical waveguides. A person skilled in the art seeking to improve the optical quality of films in silica waveguides would observe that Bouffard teaches nothing about the optical characteristics of silica films, and therefore dismiss it as irrelevant. There is no correlation between the flow characteristics forming the basis of Bouffard and the optical qualities of a film suitable for use in waveguides. The invention has more to do with the waveguide art than the use of BPSG films as insulators in chips. Wood is used for things as diverse as houses and pencils, but that does not make them analogous art. Claim 1 has been amended to specify that the process is used in the manufacture of silica waveguides.

Although Bouffard is not concerned with the optical quality of his films for use in waveguides, he does, as the Examiner rightly points out, suggest at the foot of column 4 the use of spectroscopy. However, Bouffard uses spectroscopy to determine the amounts of boron and phosphorus, which is what he is interested in. The spectroscopy as taught in Bouffard is carried out directly after the formation of the films (col. 4, line 63). It is not carried out after they have been subjected to a post temperature treatment to reduce the contaminants (see Bouffard, col. 4, lines 61-68). As taught the BPSG composition is later flowed at low temperature to smooth steps and fill trenches (see col. 1 lines 6 -25). The Examiner has taken the reference to spectroscopy in Bouffard completely out of context.

As amended, claims 1 and 21 specify that the films are free of boron and phosphorus dopants, which is one of the advantages of the invention. This is clearly contrary to the teachings of Bouffard, which only relates to BSPG, as does Ohja. Neither reference would lead one skilled in the art to make high quality optical films without such modifiers using the novel process defined in the claims. Indeed, the paragraph commencing at line 41, col. 3 of Bouffard makes it clear that the presence of P_2O_3/P_2O_5 is essential to his teachings, so one skilled in the art would not be motivated to try to make silica films without P and B following the teachings of Bouffard, yet the figures demonstrate that the applicants are able to produce high optical quality films without P and B, which is desirable for other reasons.

With regard to the feature of former claim 2, now incorporated in claim 1, the Examiner states that because the "total pressure taught by Bouffard is in the range of pressures claimed by the applicant, the total pressure in Bouffard et. al. is inherently controlled to "to minimize the presence of Si-O-H-N compounds." The applicants cannot follow this logic. The applicant's teaching is that one needs to apply the novel methodology set forth in claim 1 to identify the appropriate pressure using the FTIR spectra and then control the process at the total pressure determined by the FTIR spectra. The invention resides in this methodology, which in some ways can be likened to a business method patent, applied to a technical field. The invention teaches a novel methodology that permits a person skilled in the art how to make high quality optical silica waveguides. Without the teachings of the invention, such a person would not have known how to do this. Clearly, Bouffard does not suggest this methodology. Moreover, clearly since Bouffard teaches using

spectroscopy to determine the B or P content, there would be no motivation to use spectroscopy in the case of B and P free films following the teaching of Bouffard.

Claim 1 as amended also recites that the gases are SiH_4, N_2O and N_2. Claim 1 requires the flow rates of each of these gases to be set at fixed values while the total pressure is varied. Bouffard is completely silent as to the setting of the carrier gas or N_2 at a fixed value while the total pressure is varied as an independent variable. This is an important part of the methodology claimed and is based on the important discovery underlying the invention that you can set the flow rates and use only the total deposition pressure to optimize the quality of the film, and that using this methodology high quality optical films can be made without requiring such high anneal temperatures. Bouffard only discloses three process variables (see col. 4, line 45), not the four as claimed. Moreover, the table shows the effect of these variables on the P_2O_3/P_2O_5 ratio, whereas the invention is only concerned with the optical properties. It does not follow that optimizing the P_2O_3/P_2O_5 ratio would inherently minimize the $Si\text{-}O_x\text{-}H_y\text{-}Nz$ compounds. There is no reason why there should be a correlation. In order to sustain an obviousness rejection, the prior art must teach or suggest all the claim limitations (MPEP 2143), not just some of them. Hsieh, which relates to the fabrication of TFTs does not teach that the carrier gas flow rate affects the optical properties, and that if it is set along with the other flow rates the total deposition pressure can then be used to make high quality films that require lower anneal temperatures.

The Examiner states that the mere observation of still another beneficial result of an old process cannot form the basis of patentability. The applicants do not dispute that annealing per se is known as a method of reducing contaminants. One of the objects of the invention is to produce high quality optical films while keeping the annealing temperature as low as possible, and the applicants achieve this result with the novel methodology claimed by recognizing that the total deposition pressure is the critical parameter for controlling optical quality, and that by properly controlling the total deposition pressure it is possible to minimize of $Si\text{-}O_x\text{-}H_y\text{-}Nz$ compounds. In prior art, it was thought necessary to use higher anneal temperatures to reduce the contaminants. The Examiner has not even cited prior art showing the desirability of minimizing such compounds, which the applicants have demonstrated are critical to achieving high quality

optical films due to their absorption characteristics. A person skilled in the art, based on the cited references, would not even know to minimize such compounds in order to improve the optical characteristics.

With regard to the Examiner's rejection of claim 21 over Bouffard et al. in view of Hsieh and further in view of Ojha, it is respectfully submitted that contrary to the Examiner's statement these references in combination do not suggest the features of claim 21 as presently defined, and in particular that these features result in optical quality waveguides that can be annealed at much lower temperatures than in the prior art and without the use of P and B as demonstrated in the Figures.

With regard to the Examiner's rejection of claim 21 over Bouffard et al. in view of Ohja in view of Ngo, again it is noted that the primary reference, Ojha, is concerned with BSPG glass. None of the references teach, either alone or in combination, that P and B free films can be made of high optical quality by fixing the flow rates set forth and controlling the total deposition pressure using the FTIR spectra as an observed variable. This underlying discovery, that the total deposition pressure, is the key to obtaining optical quality films, and that the SiH_4/N_2O gas ratio is not a determining factors (see page 32, line 17) represents an important contribution to the art, which enables a person skilled in the art to easily obtain very high quality films at low anneal temperatures and without the use of P and B.

Reconsideration and allowance are respectfully requested.

Respectfully submitted,

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